CROP TALK

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Potato Leafhoppers in Alfalfa Looking to 2013

by Gilles Quesnel, Field Crop IPM Specialist,
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Last summer, potato leafhopper (PLH) certainly lived up to its reputation as the most damaging alfalfa insect pest in Ontario. In many parts of the province, PLH feeding resulted in yield loses of over 1 tonne of alfalfa per acre or roughly a loss of $200/acre. While PLH damage was far greater than normal, it went largely undetected, the lack of growth and stunting being blamed on the hot and dry weather. (Figure 1) While the lack of moisture did impact the crop, the bulk of the damage was the result of leafhopper feeding from June to mid-August.

Cropline 1-888-449-0937

Ministry of Agriculture, Food and Rural Affairs
Ontario

Damage

The visual damage of PLH is not as dramatic as the leaf shredding caused by alfalfa weevil. Rather, the insect feeds by inserting its mouth piece at the tip of the leaf and sucking plant juices from the alfalfa plant. While sucking the plant sap, PLH injects a toxin into the plant, which interferes with transportation of fluids and nutrients in the leaves. The result is the characteristic "hopperburn", which starts as a wedge-shaped "V" yellowish pattern at the leaf tips. (Figure 2)

Figure 2: Hopperburn symptoms

Loss of Yield and Quality

PLH feeding causes reduced stem elongation, reduced root development, leaf cupping and stunting. The amount of damage caused by PLH is largely dependent on the timing and level of the infestation. In 2012, PLH arrived in Ontario in late May, with the population building rapidly until early August and then crashing by mid-August. By late July, it was not unusual to find alfalfa fields with PLH populations 50 times above the control action threshold. When left untreated, high PLH populations reduced alfalfa yields by more than 1 tonnes per acre, or approximately the equivalent of a mid summer alfalfa cut. (Figure 3) PLH feeding also reduced the crude protein level of the alfalfa harvested.

New seedings were particularly hard hit this year, in some cases nearly destroying the new stands. Research indicates that reduced yield and vigour in severely damaged stands carries over to future years, and can result in increased risk of winterkill.

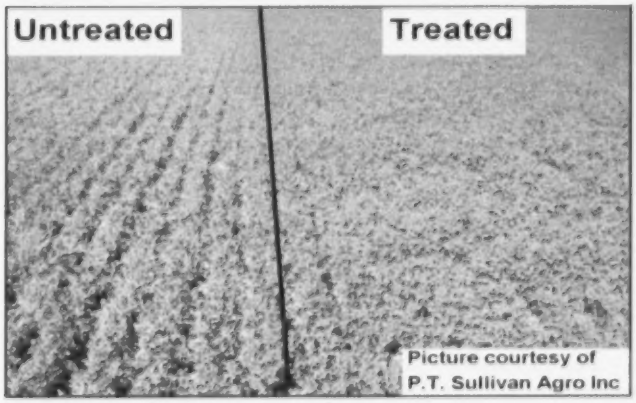


Figure 3: Two weeks after insecticide treatment

Looking to 2013

PLH do not overwinter in Ontario, but migrate annually from the Gulf States carried on weather-front air currents. (Figure 4) As such, this past season's high infestation level has no bearing on next year's infestation levels.

Economic losses from leafhoppers occur long before plant symptoms become visible. The only way to detect the presence of large leafhopper populations before the damage occurs is to scout. It is particularly important to monitor new seedings. Scouting with a sweep net starting in mid June will help determine the level of PLH infestation and whether early harvest or spraying is needed. Cost of treatment is in the $15 to $20 per acre range ($6 to $10 for the insecticide, $10 to $12 for application). For more information on PLH resistant alfalfa varieties, scouting, action thresholds and insecticide options visit: http://bit.ly/N8GaMp .

Figure 4: Adult potato leafhopper

Manure Sulphur – Digging Deeper

by Christine Brown, Nutrient Management Lead – Field Crops, OMAFRA

The addition of sulphur gave many positive yield responses in the 2012 growing season. Was it the dry growing conditions? Was it part of continuous improvement in industrial pollution control?

Whatever the reason, the impact from the positive responses to crop yields will increase the interest in sulphur use in fertilizer programs. The good news is that manure and other organic amendments contain sulphur!

Why Is Sulphur Important?

Sulphur is a part of several protein enzymes that regulate photosynthesis and nitrogen fixation in plants. It is a component of key essential amino acids for livestock.

What Form of Sulphur?

Sulphur comes in many forms. Sulphate (SO_4^{2-}) is the form needed for uptake by plants. The sulphur cycle diagram (Figure 1) shows that sulphur is present in the atmosphere as sulphur dioxide, and hydrogen sulphide. Rainwater, crop residues and animal residues (manure) deposit sulphur to the soil, mainly as organic sulphur. Other forms of sulphur in the soil include sulphides (S^-), elemental sulphur (S), and sulphate. Sulphur moves through its various forms in a similar method as nitrogen.

Most of the sulphur in soil is tied up in the soil organic matter and has to be mineralized by soil micro-organisms to the sulphate form. In the sulphate form, leaching becomes a risk, similar to nitrate-nitrogen. Sulphur volatilization is also a form of loss that increases with soil disturbance.

How Much Sulphur Is There In Manure?

Until recently, sulphur content in manure was not tested regularly. The estimates in Table 1 are based on a limited number of samples. There are differences between livestock types and within livestock types. Sulphur content in manure is impacted by the sulphur in livestock rations and in harvested feed, as well as livestock housing and storage conditions. Accurate estimates can be made from sulphur analysis as part of a manure sample.

Manure analysis information gives total sulphur. Approximately one-third of manure sulphur is in the sulphate form. The remainder is organic sulphur which becomes available more slowly with bacterial activity in warm and well aerated soils.

In Wisconsin sulphur recommendations are more routine, and sulphur availability from manure has been studied. Approximately half of the manure sulphur is assumed available to crops in the year of application. When manure is applied to the same field in consecutive years, there is residual sulphur from the previous application(s), just as with the organic nitrogen from manure. An additional credit of 10 percent is given after the second application and a 15 percent additional S credit after the 3rd application. For example, where 20 tons of dairy manure is applied to the same field every year with an analysis of 3 lbs/ton total S, the available sulphur estimate for crop production would as shown below.

Manure @ 20 ton/ac with 3 lbs/ac Total Sulphur	Available S (50% of total)	Residual Sulphur Credit	Total Available Sulphur
Year 1 application	30 lbs/ac	---	**30** lbs/ac
Year 2 application	30 lbs/ac	3	**33** lbs/ac
Year 3 application	30 lbs/ac	4.5	**35** lbs/ac

Table 1: **Approximate Sulphur Content From Various Manure Types (as-applied)**

Manure Type	Solid lbs/ton (kg/T)	Liquid lbs/1000 gallons (kg/1000 L)
Hog	---	4 to 7 (0.4-0.7)
Dairy	1 to 2 (0.5-1)	2.5 to 4 (0.25-0.4)
Beef	2 to 4 (1-2)	3 to 5 (0.3-0.5)
Poultry	4 to 6 (2-3)	9 (0.9)
Biosolids	~5 (2-3)	---
Biosolids Pellets	15 to 20 (7-10)	---
N-Viro	55 to 60 (27-30)	---
Greenbin Compost	2.5 to 5 (1.3-2.5)	---

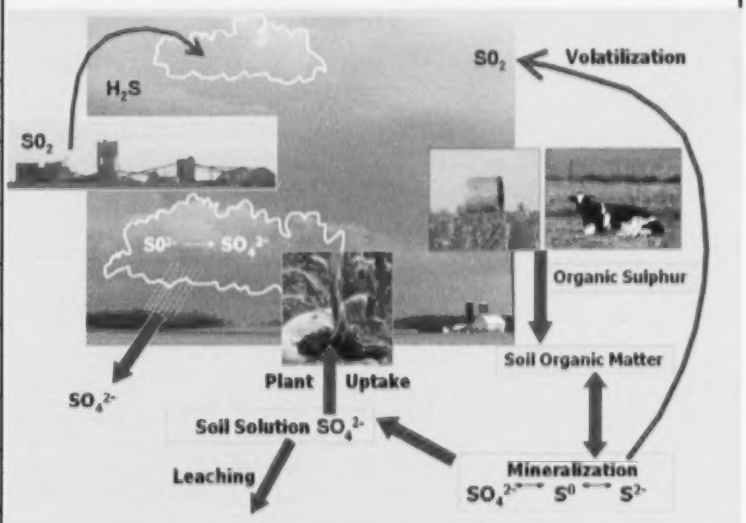


Figure 1: Agriculture Sulphur Cycle

How Much Sulphur Do Crops Remove?

High yielding crops that fix nitrogen remove the highest amount of sulphur. Table 2 shows the approximate amount of sulphur contained in common field crops with average yields. Manure sulphur is not always sufficient for high producing crops. However, crop response to commercial sources of sulphur is less common where manure is applied regularly.

Table 2: Approximate Amount of Sulphur Contained in Field Crops

Crop	Yield /acre	Sulphur lbs/ac	Crop	Yield /acre	Sulphur lbs/ac
Grain Corn	150 bu	10	Wheat grain	80 bu	6
Corn Stover	4.5 ton	15	Wheat straw	3 ton	10
Soybeans	40 bu	4	Barley grain	60 bu	4.5
Canola	45 bu	15	Barley Straw	1.5 ton	6
Dry Beans	30 bu	5	Oats grain	80 bu	5
Alfalfa	5 ton	25	Oats Straw	2 ton	9
Red Clover	2.5 ton	7	Rye grain	45 bu	10
Timothy hay	2.5	5	Rye Straw	2 ton	4

From Table on pg 26 – Managing Crop Nutrients BMP

Risks of Tight Canola Rotations

By Brian Hall, Canola & Edible Bean Specialist, OMAFRA

Grower and research results clearly indicate that short canola rotations don't work. Some Ontario growing areas have been shortening their canola rotation interval (years between canola crops).

Yield Losses

In Western Canada, canola economics is pushing growers to grow canola using a short rotation interval, and even canola on canola residue. Western Crop insurance records over a 6 year period showed that canola-on-canola yielded the lowest, with 16 – 20% less yield than canola with a 1 - 2 year break. A three year break yielded the best, with 5% more than where a 1 - 2 year break between canola crops was practiced. These results indicate that at today's canola price, growing canola after canola will gross you $120/acre less (20% less yield on 1 t/ac yield) on average. It may also increase costs by requiring more fungicide to manage the increased risk sclerotinia.

A 9-year Western Canada research trial confirmed these grower results, showing that the gross return of canola-on-canola was $100 - $150/ac less than that of a 4 year rotation. A 1 - 2 year break between canola crops restored much of yield drop, but still not as good as the 3 - 4 year rotation. So what are the risks?

Disease

Surprisingly, the research study did not show an economic benefit to fungicide application in the continuous canola, even though it is well known that sclerotinia disease risk increases with short rotations between susceptible crops. Blackleg, seedling diseases, and clubroot all increased with shorter rotations. Clubroot (Figure 1) could be a real sleeper disease because there have not been reported cases of the disease in Ontario even though the disease exists here. This is likely because growers have always maintained good canola rotations. The soil-borne disease can be a real problem, as there are few control options, resistant varieties are just now becoming available, and once you have it in your field, it will always be there. Seedling diseases become more intense, causing stand reductions despite the use of seed treatments.

Insects

Flea beetles and Swede midge can become more intense because of the favourable environment for the pests to multiply and over winter. It was clear that Swede midge levels in 2012 were higher where later planted canola was grown nearby in 2011. Root maggots, for which there is no control, can also increase.

Weed Control

The limited herbicide options in canola will mean growers will need to be more vigilant at controlling volunteer canola and dominant weeds in rotation crops.

The profitability of canola encourages shorter rotations, but the short term gain can result in longer term pain. The best strategy to managing pest problems and building resiliency into your canola yields is through a 3 - 4 year canola rotation.

Figure 1: Clubroot (courtesy Canola Council)

Ontario Biomass Tour – Did You Miss It?

by Ian McDonald, Applied Research Coordinator and Scott Banks, Emerging Crop Specialist,, OMAFRA

The 2nd Annual Ontario Biomass Tour, held September 17 - 27, highlight a range of bioeconomy activities in across the evolving biomass value chain.

There are currently about 2,000 acres of perennial biocrops in Ontario. These biomass crops include native perennial grasses, such as switchgrass, bluestem, Indian, cordgrass, and others. These were the original species in the native tall grass prairie that covered much of eastern and central North America. The other potential biomass species is miscanthus, which is a native of Asia.

Agronomic Advantages

Once established, these perennial grass crops offer many advantages over traditional grain crops, including:

- no tillage requirement,
- low pesticide and fertilizer requirements make them relatively cheap crops to grow,

- harvest times are during the very late-fall to early-spring which do not interfere with grain crops,
- traditional haying equipment can handle these heavy, high yielding crops with minor adjustments.

Yields have been running in the 4 - 6 tonne / acre range (dry matter) for switchgrass and 8 - 10 tonnes / acre for Miscanthus. Yields vary due to geography (heat), soil type and stand age.

Establishment Challenges

The biggest hurdle for farmers trying these crops is the patience needed to get past the first couple of years during establishment. These warm season perennial grasses are weak competitors until they are established. Establishment can be a slow painful process for farmers used to the rapid growth and weed-free fields associated with most grain crops.

The tour took us to new fields and back to fields we had toured last year. It was very encouraging to see fields this year that were flourishing, with heavy stands of switchgrass at chest height and Miscanthus well above our heads. Many of these fields had looked very poor last year, which highlights the need to be patient. We have the knowledge to establish thick resilient stands. Establishment systems that don't start out right are going to be problematic and continue to be lower than acceptable performers. It was obvious from viewing fields in Bruce and Grey Counties, that trying to establish these grasses into sod that is simply killed off with glyphosate and then planted no-till are going to be slow to establish and potentially weak for a long time. Similarly to renovating a long term pasture, the establishment of biomass grasses without first controlling perennial weeds will be a battle. Options on landscapes sensitive to tillage or even no-till annual crops may be limited. In these cases, the transition to perennial biomass crops may be especially slow. However, where herbicides, fertility and other management choices can be used, establishment can be quick enough to have harvestable yield by the end of the second year.

End Markets For Biomass

The tour also explored end use markets for biomass. New Energy Farms, Leamington, is blending biomass with recycled plastic to feed through standard plastic extrusion machinery for the production of any kind of widget. Last year Home Hardware did a run of over 100,000 biobins sold across Ontario. These bins were undistinguishable in durability, quality, and colour choice from bins made from virgin plastic resin.

Myers Company, Brantford, is testing plastic film from biomass to use in the production of bioplastic pots for the nursery and greenhouse industries. The company is looking at recycling the bioplastic pots into regenerated film that can in turn be run through the system to produce the next generation of pots. This technology was developed by the Bioproducts Discovery and Development Centre at the University of Guelph, Department of Plant Agriculture.

Nott Farms, Clinton, is exploring the use ag biomass in non-structural building materials, including a direct replacement for traditional chipboard. The significant advantage of this product is that it doesn't use formaldehyde in the process. A large test run is being conducted using wood biomass at a plant in Alberta. The technology and process is directly transferable to ag biomass. This may lead to a potentially large and steady market for ag biomass.

Biomass for heat was one of the original markets for biocrops. This market has cooled somewhat with the current prices of natural gas. However, significant numbers of homes and businesses do not have access to natural gas. Oil, electricity and propane heating costs are substantial and increasing. Gildale Farms of St. Marys, Friendly Fuels of Drumbo, Willowlee Sod Farm Ltd.of Amielsburg, Switchgreen of Seelys Bay, Northern Metalworks of Sunderland, and the NRCanmet Labs of Natural Resources Canada in Ottawa were stops that highlighted the potential for producing heat from biomass. Commercial biomass boilers are available of various sizes from North American and Europe. NRCan has found that a wide range of biomass fuels are usable in this equipment. Further engineering to ensure emission standards and thorough combustion is underway. Canmet is looking at finding the right biomass fuels and optimizing their combustion.

Biomass crops are being used as bedding alternatives and compost replacement in the mushroom industry due to shortages of straw and alternatives across North America were highlighted. These biomass crops seem to be more durable to moisture than cereal straw and make excellent bedding and compost.

Biomass Processing

Pelleting, briquetting, and chipping have been explored. Dr. Animesh Dutta's lab at the University of Guelph, College of Engineering, has been researching the technology of torrification. They have solved a couple of the biggest hurdles of large scale use of biomass - densification to enhance storability and transportation of otherwise bulky low density biomass. This process will enhance the ability of biomass to penetrate more traditional petroleum-based markets. Making pure biomass pellets without additives that are hard enough to endure handling and transport continues to be a significant hurdle.

This was a very successful tour highlighting some real success stories and profiling some new emerging opportunities. Join us next September for the 3rd Annual Biomass Tour.

Grain Gadgets and Ideas

By Helmut Spieser, Engineer, OMAFRA Ridgetown

Harvest is again under way and corn will be heading to the dryer or directly into storage bins. As you travel and visit other farmers' grain handling and storage systems you see things that are simple but make life a little less stressful.

Figure 1. The "Y"-shaped bypass/fill diverter is mounted at the top of the bin.

Bypass / Fill Diverter (Figure 1)
How many times have you accidentally put corn on top of soybeans? With this bypass / fill diverter this should not happen. The diverter is connected to the end of the down spout at the top of the bin and directs grain flow either into the bin or to a bypass pipe. The bypass pipe is fastened along the outside the roof and the bin wall and terminates six feet off the ground. When a bin has been filled, the diverter is moved to the bypass position and locked with a padlock from the ground. If grain is sent down to this bin, it will be diverted to the bypass pipe and lands on the ground. The farmer who has this system has paved the space between all the bins with concrete. Yes, there will be some cleanup required but the bin is not contaminated

Hopper Wagon Dump Assistant (Figures 2 and 3)
Wet corn tends to stick in hopper wagons preventing thorough cleanout. Some farmers have tried using graphite paint on the wagon floor to aid in cleanout. If corn still sticks, here's a dump assistant. This home-built platform uses hydraulic cylinders to lower the platform from its vertical storage position. Hydraulics are then used to increase the platform height raising one side of the wagon almost a foot. Corn has no way of staying in the box and no banging is required.

Figure 2. Wagons driven onto the four inch high ramp aids in complete unloading

Figure 3. A hydraulic cylinder raises this ramp to a height of 12 inches for gravity unloading of sticky grain from a hopper wagon.

Dump Aligner (Figures 4 and 5)
When you are pulling in a train of wagons, it is sometimes difficult to hit the dump pit exactly. Here is a low cost system that works. It uses a garage door safety sensor and some reflective tape. The safety sensor is mounted to a structural steel member beside the unloading grate and aimed at the side of the wagon.

When the wagon chute is lined up with the unloading grate, a strip of reflective tape is fastened on the side of the wagon, directly in front of the safety sensor. When the sensor signal bounces back from the reflective tape, it activates a red light which is visible to the tractor driver, indicating that the wagon chute is perfectly aligned with the unloadable grate. Every wagon gets its own strip of reflective tape. Neighbours who bring in grain could also add reflective tape to their own wagons.

Figure 4. The safety sensor is mounted on a steel column facing grain wagons parked ready to unload

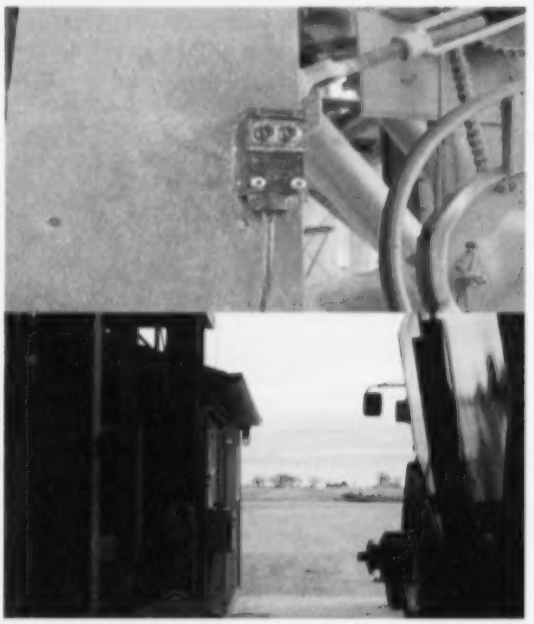


Figure 5. A red light, which is visible from the tractor driver's seat, when the wagon chute is lined up with the unloading grate

Shaft Speed Sensors (Figures 6 and 7)
If your system has a leg elevator, a dryer and conveyors you may be a candidate for shaft speed sensors. Shaft speed sensors are used to measure speeds of critical shafts in your system. The control system monitors shaft speeds and will provide operator notification when speeds fall outside critical ranges. More sophisticated systems can shut down equipment before damage occurs. In this way things like plugged legs would be a thing of the past. This system would also let you know a belt is broken before down spouts are plugged.

Figure 6. A shaft speed sensor shown on the shaft of an elevator boot

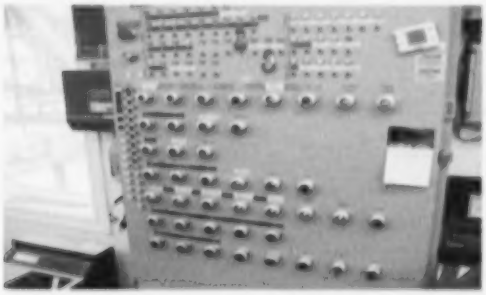


Figure 7. Control panal showing push button controls for various grain system components

Grain Auger Sampling (Figures 8, 9 and 10)
Knowing the moisture content of grain moving through your system allows you to make appropriate management decisions. Augers can inflict serious damage to life and limb so you don't want to try to sneak out a sample. Grain samplers are mounted on the auger tube allowing you to take samples without putting yourself at risk. Samplers are installed 45° from the bottom of the auger tube. A small opening in the auger tube allows corn to trickle out when the sampler is open. In this way they allow for a more representative sample of grain to be taken. These samplers are available from your local bin supplier or they can be home-built.

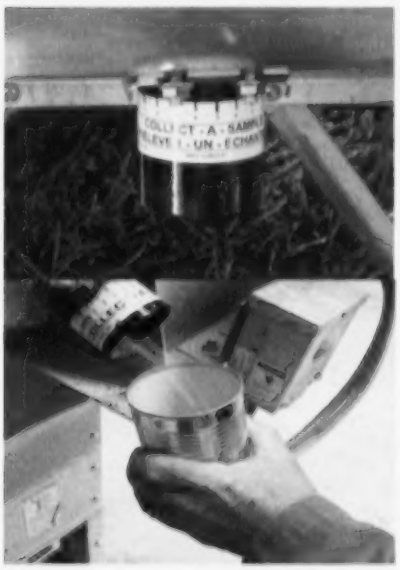


Figure 8. A collect-a-sample installed on a horizontal auger

Figure 9. Corn dribbles out of a collect-a-sample into a soup can

Figure 10. A one and a half inch square home made grain sampler welded to a horizontal auger tube

Unloading Hopper (Figure 11)
Wagon chutes always seem to be wider than dump pit grates. As a result, grain spills onto the surrounding concrete and cleanup is needed every time a wagon or truck leaves. This portable welded steel hopper is rolled into place before the wagon unloads. This hopper minimizes the amount of grain that spills onto the concrete and results in a lot less sweeping.

Figure 11. A moveable metal hopper directs corn from a hopper wagon into the un

Blow Out Doors (Figure 12)
Perforated bin floors allow fine material to fall down into the space below. The bin use and type of perforated flooring will affect the amount of material that accumulates. Over the years, fine crop material can reach a depth that can hinder airflow under the aeration floor. Cleaning out under the perforated floor is never an easy job. Blow out doors are now available to get this material out of the bin. A number of these doors are installed around the skirt of the bin. When the bin is full and the material under the floor is dry, the doors are removed one at a time and then the fan is turned on. After the fan is turned off the door is reinstalled and the next one removed. Let your aeration fan do your under floor cleaning.

Figure 12. A steel blowout door 6 inches by 18 inches is bolted into a cutout in the bin skirt below the aeration floor

Should Ammonium Sulfate Be Added To Glyphosate?

by Mike Cowbrough, Weed Specialist, OMAFRA

It seems to be an annual question. Do I add ammonium sulfate (AMS) to glyphosate? Will it improve weed control especially if my water source is hard? The short answer is no. Skeptical? I understand.

There are many areas within the United States that insist the addition of AMS to glyphosate is critical, particularly for the control of lambs-quarter and velvetleaf. It has been well documented that certain cations in hard water can antagonize glyphosate activity (eg Ca++). This antagonism may result from the formation of glyphosate salts of low solubility. These salts are not taken up as readily by the plant, and therefore weed control may be reduced. Growers in the US will add AMS to glyphosate as a cost-effective way of overcoming this antagonism, as AMS hinders the formation of low soluble glyphosate salts.

Sources of Cations

Hard water is the most common source of cations. However, plant tissue can also produce antagonistic cations that leach onto the leaf surface when dew or rainfall wets the leaves. This may explain why the addition of AMS to glyphosate has improved control of certain weed species, even when glyphosate is mixed with de-ionized water.

A study by Gavin Hall and colleagues (2000) looked at the composition of cations on the leaf surface of velvetleaf, field bindweed, and johnson grass. Control of these weeds was evaluated when applying glyphosate with and without the addition of AMS. Their results found that the greatest response in control from the addition of AMS to glyphosate was seen on velvetleaf, followed by field bindweed. There was little difference in the response of johnson grass to treatments of glyphosate with and without AMS. The response to AMS mirrored the relative concentrations of calcium within the foliar tissue as velvetleaf contained the highest concentration of Ca^{++} followed by field bindweed and johnson grass. Results from the Hall study suggest that calcium on the leaf surface and within the plant tissue can antagonise glyphosate activity.

The Ontario Experience

One of the first projects I worked on when I started with the Ministry was a series of field scale demonstrations where farmers with velvetleaf as a target weed agreed to spray half their field with glyphosate, re-fill the sprayer with water, condition with ammonium sulfate and then add the same rate of glyphosate to treat the rest of the field. In every demonstration conducted, the farmer did not notice a difference in velvetleaf control between the two areas of the field.

In 2011, a study by Ontario researchers concluded that in their experience "water hardness and AMS had little benefit on the efficacy of glyphosate in corn". The two charts below have been adapted from this study to show the difference in weed control by glyphosate with and without ammonium sulfate to condition three levels of water hardness.

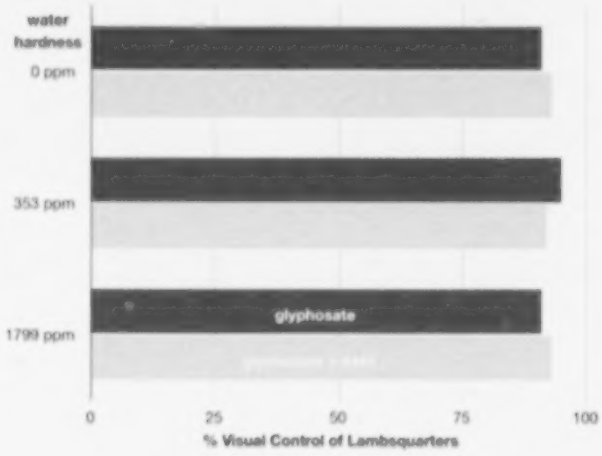


Figure 1. Control of lambsquarters 28 days applications with glyphosate and glyphosate + ammonium sulfate at three levels of water hardness. Adapted from Soltani et al., 2011. Can. J. Plant Sci. 91: 1053–1059

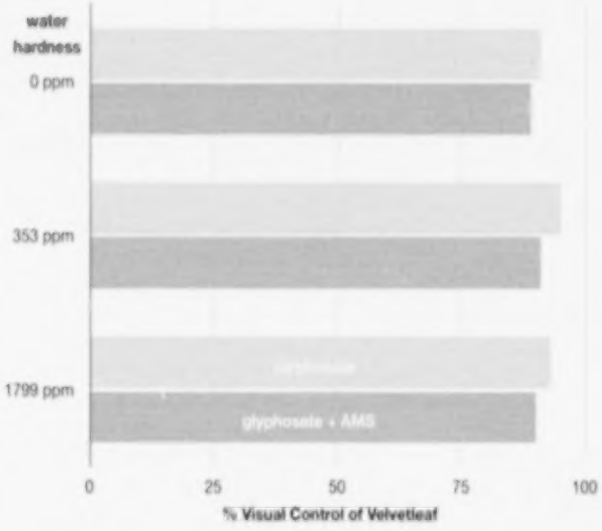


Figure 2. Control of velvetleaf 28 days applications with glyphosate and glyphosate + ammonium sulfate at three levels of water hardness. Adapted from Soltani et al., 2011. Can. J. Plant Sci. 91: 1053–1059.

Situations Where AMS Added To Glyphosate May Warrant A Look

A quick google search will yield you no shortage of articles on the value of adding AMS to glyphosate, so I can appreciate why you may view this article with some scepticism.

A really good resource on understanding glyphosate to increase performance is on the Purdue website http://www.extension.purdue.edu/extmedia/gwc/gwc-2.pdf.

If you want to evaluate the conditioning of water with AMS, you may see benefits when:

1. You are using spray water that is very hard.
2. You are targeting weeds that are known to have leaves that are "Cation rich" like lambsquarter and velvetleaf.
3. You use glyphosate products that aren't "fully loaded" (e.g. premium brands)

Banding Nutrients and the Effect On Soil Sampling

by Bonnie Ball, Soil Fertility Specialist, & Deanna Nemeth, Nutrient Management Program Lead – Horticulture, OMAFRA

Placement of fertilizer and manure in bands near the plant enhances nutrient use efficiency. In reduced- and no-till systems with nutrient banding, effective soil sampling to gauge 'true' soil test values requires attention to the number of cores collected within and outside the influence of the band.

Why Is Banding Recommended Rather Than Broadcasting?

- Nutrients placed near roots are available for plant uptake.
- Most crops have high demand for phosphorus early, before root systems are extensive.

Why Phosphate Should Never Be Broadcast In Row Crops

- Phosphate gets "tied up" or fixed into less available forms, reducing value from your fertilizer dollar.
- Phosphate stratifies at the surface in no-till systems, where there is no root activity and uptake once soil dries out.
- Phosphate can run off into surface waters, contributing to algae growth. This is an environmental issue, especially in Lake Erie. Run-off also reduces the value from your fertilizer dollar.

Changing How We Soil Sample To Account For Nutrient Banding

"True" or average soil test values are the basis for fertilizer rate recommendations. When your soil test underestimates the P and K, it results in wasted input dollars, while overestimating can reduce yields. Where cores are taken relative to the previous nutrient band has a large effect on soil test results. Beyond 5 cm (2 in) from a planter-placed phosphate band, soil P concentration drops sharply and there is little fertilizer effect outside of this area. Recommendations on how to collect soil cores from fields with banded nutrients in reduced or no-till scenarios are summarized in Table 1.

Table 1. Recommended sampling schemes to approximate 'true' soil test value

Scenario	Band Spacing cm or (inches)	Placement	Collect
1	unknown	planter	Paired sampling – 1 random core followed by a 2nd core 50% of the band-spacing distance from the 1st sample, perpendicular to the band direction
2	76 (30)	planter	1 core within the band for every 20 out of the band
3	30 (12)	planter	1 core within the band for every 8 out of the band
4	to determine with any spacing	planter	S = 8 [x/30 cm] (*S* = 8 [x/12 inches]) *S* = number of cores between bands (outside influence of band, 5 cm for planter placed fertilizer) x = band spacing in cm or inches
5	76 (30)	strip till, manure injector	1 core in the zone for every 3 out of the zone, where zone of influence is 25 cm (10 inch) wide

Sources: Fernandez 2012 Soil P and K following RTK-guided broadcast and deep-band placement in strip- and no-till, Self-study CEU, Crops & Soils Jul-Aug. Kitchen, Westfall, Havlin 1990 Soil sampling under no-till banded phosphorus, Soil Sci. Soc. Am. J. 54:1661-1665. Ball Coelho, Roy, Bruin, More, White 2009 Zonejection: Conservation tillage manure nutrient delivery system, Agron. J. 101:215-225

Obtaining a sample of the 'true' value is more difficult where the location of the band is unknown or varies from year to year (Scenario 1).

Where location of the band is known and is the same each year, sampling is simplified and accuracy improved (Scenario 2 - 5). Maintaining a constant band location is becoming more practical and popular with Real Time Kinematic (RTK) guidance, a Global Positioning System (GPS) with centimetre level accuracy. Plants are located on or near the residual fertilizer bands each year, and compaction is reduced through controlled traffic.

Soil Test Differences Within and Between Bands

On an Ontario farm with corn and soybeans grown in rotation on the same twin row spacing and location each year, composite samples were prepared from soil cores collected:

1. in the fertilizer band (placed 4 inches either side of the row each year)
2. outside of the influence of the band (Figure 2)
3. 1 core within the band mixed with 20 cores outside the band
4. 1 core within the band mixed with 10 cores outside the band.

Soil test P and K were 1.7 times greater in the band than outside the band (Figure 3). These results show there is risk of underestimating and over applying P and K to your crop if all cores are collected outside the band.

When a mix of cores taken inside and outside the band was evaluated, P and K values were lower than P and K values within the band (Figure 3). Soil test P and K were similar for the composite of "1 : 20", which is the recommended scheme for 30 inch rows (Table 1, Scenario 2), as for the composite of "1 : 10" cores from the band (Figure 3).

To estimate 'true' soil test value in this system, a soil composite of about 15 cores out of the band and one core in the band is a practical way to sample.

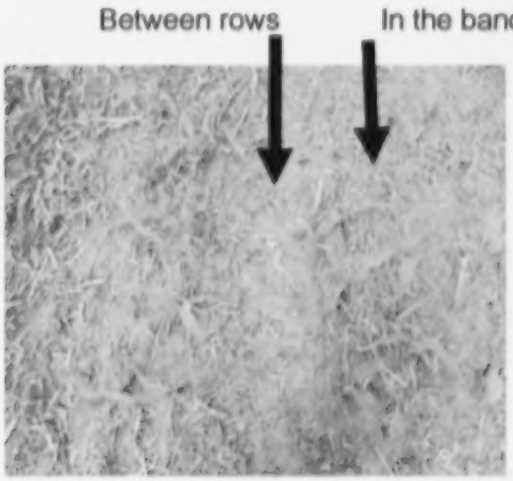
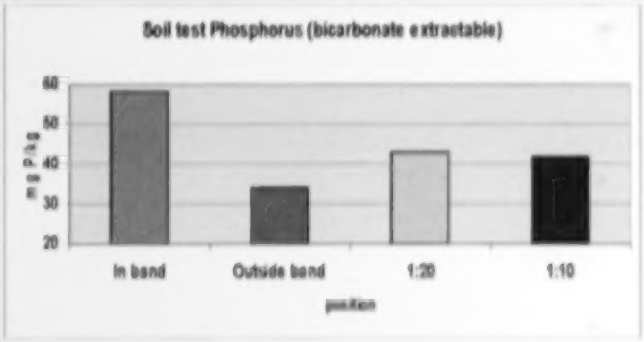


Figure 2. Soil core locations with respect to twin rows and banded fertilizer P and K



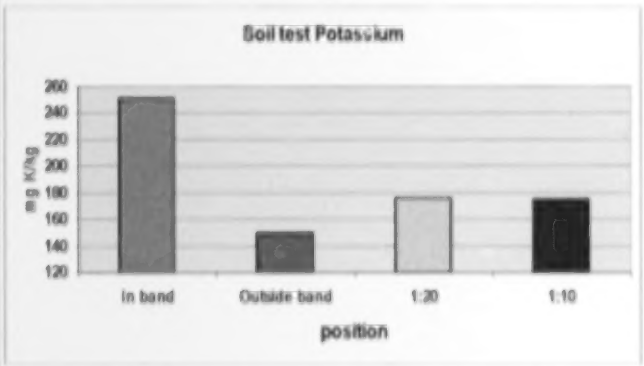


Figure 3. Soil test phosphorus (P) and potassium (K) with cores collected: in the planter-placed fertilizer band; outside the band; and composites of 1 core within the band for every 20 (1:20) or 1 for every 10 cores (1:10) outside the band.

Banding nutrients is an efficient and responsible method of placement. When soil sampling reduced or no-till fields, the number of cores collected within and outside the influence of the band should vary according to the spacing between bands and zone of influence of the band.

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